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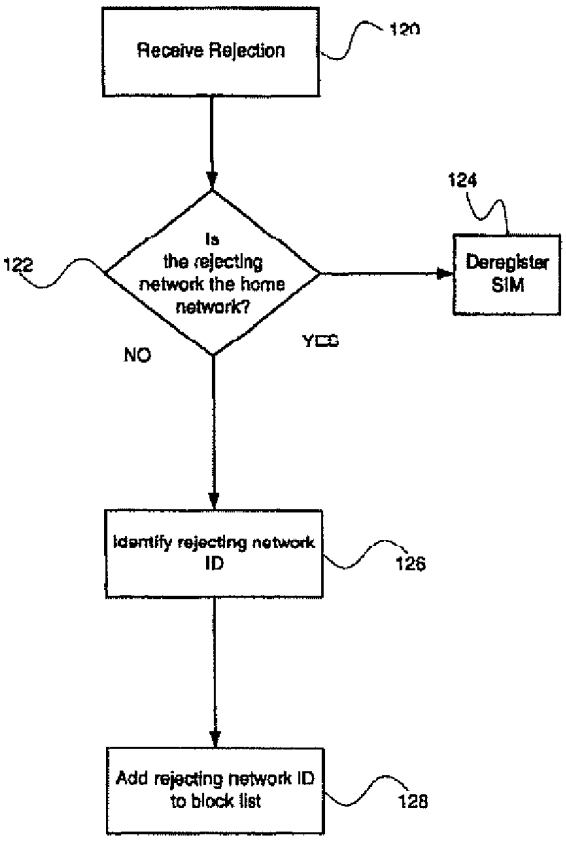
(54) Title: MOBILE DEVICE AND METHOD FOR HANDLING GPRS ATTACH REJECTION



(57) Abstract: A mobile device (400) and method for handling GPRS attach rejections due to GPRS Services Not Available are disclosed herein. The disclosed mobile device and method allow a mobile subscriber to receive a GPRS Services Not Available rejection (120) and then make subsequent GPRS connections to other networks by adding the rejecting network ID to a block list (128) and then not connecting to a network, the ID of which is on the block list (134). In an embodiment, receiving a GPRS Services Not Available rejection from the home network will result in a deregistration of the subscriber identification module.

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MOBILE DEVICE AND METHOD FOR HANDLING GPRS ATTACH REJECTION

This application claims the benefit of priority from U.S. Provisional Application No. 60/324,510 filed on September 26, 2001.

FIELD OF THE INVENTION

[0001] The present invention relates generally to the handling of a rejected connection by a digital mobile device. More particularly, the present invention relates to a method of handling a GPRS Attach rejection without blocking all future GPRS connections.

BACKGROUND OF THE INVENTION

[0002] In the field of wireless communications, digital cellular phones have supplanted analog cellular phones in sales for a variety of reasons. Foremost among those reasons is the security and clarity provided by digital cellular phones that can be directly attributed to the fact that in a digital cellular phone, voice data is digitised prior to transmission. The digitisation of the analog voice data allows for better security, and error correction, which improves clarity. Because digital cellular phones are already transmitting voice as a data stream, they have also been used as wireless MODEMs. Unfortunately, the use of digital cellular phones as wireless MODEMs has been impaired by their low data transfer rates. Many cellular phones cannot transmit data as quickly as a landline MODEM.

[0003] The solution to the low adoption of the use of digital cellular phones as wireless MODEMs has been the introduction of high-speed wireless data services. Foremost among these services is the General Packet Radio Service (GPRS). GPRS is the data service companion to the Global System for Mobile communications (GSM) standard. While acting as GPRS MODEMs, digital cellular phones allow data communications at rates in excess of 40 kilobits per second (kbps) with some systems offering data transfer rates in excess of 100kbps.

[0004] To provide security for transmitted data, encryption is employed on all outgoing data packets using a technique similar to that used to encrypt voice communications, as will be well understood by one of skill in the art. However, it is still

necessary to determine whether or not the user of a cellular mobile device has been authorised to make GPRS communications. Standard methods for authentication exist and have been codified in the standards promulgated by the Third Generation Partnership Project (3 GPP).

[0005] To allow their subscribers to have both voice and data services outside of their coverage areas, many network operators have roaming agreements with other networks. As a result, it is possible for cellular network subscribers to travel internationally, and have their cellular device roam on a compatible foreign network. Due to the wide adoption of the GSM standard, international travel with a GSM cellular phone provides the best opportunity for a user to have international roaming abilities.

[0006] International roaming is permitted by cellular carriers as a concession to users' needs for service wherever they travel. With the emergence of wireless data communications, GPRS provides similar roaming abilities in compatible mobile devices.

[0007] When a mobile device is activated, it examines its Preferred Roaming List (PRL) to determine which network it will attempt to connect to. Preference is typically given to the home network. If the mobile device cannot connect to its home network, the PRL lists the order in which secondary, tertiary, and other networks are searched. In certain cases a user is provided the option to select the network on which the mobile device will roam.

[0008] Upon connecting to a foreign network, the mobile device is authenticated through communications with a Visiting Location Register (VLR). Typically, the mobile device transmits an International Mobile Subscriber Identity (IMSI) to the VLR. A sequence of digits in the IMSI allows the VLR to determine the home network of the mobile device. Authentication of the mobile device can then be carried out through a communication between the mobile device and the VLR, and the VLR and a Home Location Register (HLR) on the mobile device's home network.

[0009] When a GPRS connection is sought on a roaming network the VLR requests a copy of the user profile from the HLR and provides it to the Serving GPRS Support Node (SGSN). After a copy of this profile has been received, and the user has been authenticated, the SGSN assigns a temporary mobile subscriber identity (TMSI) or a Packet TMSI (P-TMSI) to the mobile device. When the mobile device is notified of its TMSI, it is able to connect to the roaming network and begin a GPRS session. This

process is referred to as a GPRS Attach and is well understood by those of skill in the art. In the event that a mobile device cannot be authenticated, the roaming network issues an attach rejection with cause. The 3GPP specification provides for a number of causes that are typically transmitted to the mobile device to identify why GPRS services are unavailable. One of the causes is "GPRS Services Not Allowed". According to the 3GPP specification, a mobile device that receives an "GPRS Services Not Allowed" attach rejection will delete its TMSI and will update a status field in its Subscriber Identification Module (SIM) to create a new state called "GMM-deregistered". In this state, a mobile device is unable to establish a further GPRS connection with other networks. To resolve this problem, a subscriber is required to either replace the SIM, or return to the home network operator and have the SIM reprogrammed.

[0010] This situation is highly undesirable to a mobile subscriber who is travelling. A refusal to attach to a single foreign network would prevent the user from attempting to create a data connection to another network. Replacement of the SIM essentially provides the mobile device with a new identity, which is undesirable, because it results in a new phone number, and could entail making all phone numbers stored in the SIM unavailable. Though returning to the home network operator is always possible, it is not always feasible to do if the subscriber is overseas, and requires data services while abroad.

[0011] An overview of the method of connecting to a GPRS network is provided in Figure **1**. At step **100** the mobile device attempts to connect to the VLR. In step **102**, the mobile device receives from the VLR an authentication request. In response to the received authentication request, authentication data is transmitted to the VLR in step **104**. A reply to the authentication data is received in **106**. The reply is examined in step **108** to determine if the reply is a rejection from the network. If the reply is not a rejection, the mobile device proceeds to step **110** wherein it acknowledges the GPRS connection and starts the GPRS session with the assigned P-TMSI or TMSI. If the received reply is determined, in step **108**, to be a rejection, the mobile device proceeds to step **112** wherein it deregisters the SIM. One of skill in the art will readily appreciate that there are a number of authentication requests that can be made of the mobile device. In a first embodiment, the VLR asks for an identity request. In response the mobile device would provide the VLR with the IMSI. Alternatively, the roaming network can provide an authentication or a cipher request. In response to this request, the mobile device would provide the network

with the authentication or cypher response. Other challenges used in network authentication will be well understood by those of skill in the art.

[0012] Though this method provides mobile device authentication, and is able to block unauthorized mobile devices from continually requesting GPRS services, it can unfairly impair a user's ability to connect to other GPRS networks. There may be a number of reasons that would cause a network to reject a connection, and resolution of the underlying reason without re-programming of the SIM will not allow the user to connect to any GPRS networks. As a result, mobile subscribers on the first leg of international travel who are prohibited from making a GPRS connection will be unable to make a subsequent GPRS connection until they are able to contact their home network and have their SIM reprogrammed.

[0013] Network operators are wary of allowing a mobile device to repeatedly request a connection after it has been rejected. Constant requests consume valuable resources, including RF bandwidth, that could be more appropriately used elsewhere. Additionally, constant requests for service could provide an attacker with valuable regarding the state of the network, or could themselves be part of a denial of service attack. For these security reasons network operators are loathe to allow a mobile device to request services after the "GPRS Services not Allowed" rejection has been made.

[0014] Thus, it would be desirable to provide a method for a mobile device to handle a GPRS Attach rejection that provides network security, by not allowing an unauthorized mobile device to continually request service, while still providing the mobile subscriber the ability to connect to another GPRS network at a later date, if the underlying condition for the network rejection has been resolved.

SUMMARY OF THE INVENTION

[0015] It is an object of the present invention to obviate or mitigate at least one disadvantage of previous methods of handling GPRS Attach rejections at a mobile device.

[0016] In a first aspect of the present invention there is provided a method for handling a Generalised Packet Radio Service (GPRS) Attach rejection, from networks having network identifiers, at a digital wireless mobile device associated with a home network. The method comprises receiving a GPRS Attach rejection from a network and adding the network identifier of the rejecting network to a block list, which prohibits the

mobile device from re-establishing a connection with a listed network. In an embodiment of the present invention, the step of adding the network identifier to a block list is performed only if the rejecting network is determine to not be the home network. In another embodiment of the present invention, the determination that the rejecting network is not the home network is made by comparing an International Mobile Subscriber Identity (IMSI) associated with the mobile device to the network identifier of the rejecting network. In a further embodiment of the present invention the mobile device is deregistered if the rejecting network is the home network. In another embodiment of the present invention receiving the rejection includes receiving a GPRS Services Not Allowed rejection.

[0017] In a second aspect of the present invention there is provided a method of initiating a data connection to networks having network identifiers, from a mobile device having a network block list containing a list of blocked network identifiers. The method comprises receiving a network identification number from a network and receiving and replying to an authentication request if the network identification number does not reside in the network block list, otherwise disconnecting from the network. In an embodiment of the present aspect of the invention, receiving the authentication request includes receiving a request for a cipher code, and replying to the authentication request includes retrieving the requested cipher code from a Subscriber Identification Module (SIM) and transmitting the retrieved cipher code to the network. In another embodiment, receiving the authentication request includes receiving an Identity Request, while replying to the authentication request includes retrieving an IMSI from a SIM and transmitting the retrieved IMSI to the network. In a further embodiment, the step of receiving a Temporary Mobile Subscriber Identity (TMSI) from the network in response to the reply, where the TMSI is optionally a packet temporary mobile subscriber identity assigned by a Serving GPRS Support Node in the network.

[0018] In a third aspect of the present invention there is provided a mobile device, associated with a home network, for data communication with networks, associated with network identifiers, through a transmitter and a receiver, the mobile device having a subscriber identification module for storing identifying information. The mobile device comprises a processor and a block list. The block list is for storing network identifiers associated with networks that have rejected connections. The processor is for

disconnecting from a network if the network identifier associated with the network is in the block list, and for adding a network identifier to the block list if the network associated with the network identifier rejects a connection. In an embodiment of the third aspect of the present invention, the processor includes means for adding a network identifier to the block list if the network associated with the network identifier rejects a connection, and is not the home network, and the processor includes means for determining if the rejecting network is the home network by comparing the network identifier to an IMSI stored in the SIM. In an alternate embodiment, the processor includes means for deregistering the SIM if the rejecting network is the home network. In another embodiment, the processor includes means to transmit the identifying information stored in the SIM to the network, through the transmitter, in response to an authentication request. In yet another embodiment of the present invention, the block list resides in the subscriber identification module. In a further embodiment, the processor includes means for adding a network identifier to the block list if the network associated with the network identifier rejects a connection due to GPRS Services Not Available.

[0019] Other aspects and features of the present invention will become apparent to those ordinarily skilled in the art upon review of the following description of specific embodiments of the invention in conjunction with the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] Embodiments of the present invention will now be described, by way of example only, with reference to the attached Figures, wherein:

Fig. 1 is a flowchart illustrating a prior art method of GPRS Attach rejection handling;

Fig. 2 is a flowchart illustrating a method of GPRS Attach rejection handling according to an embodiment of the present invention;

Fig. 3 is a flowchart illustrating a method of initiating a GPRS Attach request according to an embodiment of the present invention; and

Fig. 4 is an illustration of a mobile device according to an embodiment of the present invention.

DETAILED DESCRIPTION

[0021] Generally, the present invention provides a mobile device for, and a method of, handling a GPRS Attach rejection, that allows for network security, and will not prevent a mobile subscriber from being barred from every GPRS network as a result of a single GPRS Attach rejection.

[0022] The present invention, in a presently preferred embodiment, will prohibit a mobile device from connecting to any GPRS network if a rejection is received from the mobile device's home network. If a rejection is received from a network that is not the home network of the mobile device, the mobile device will be prevented from making a GPRS connection to that one network. This allows the mobile subscriber to attempt to make GPRS connections to other networks. This allows the mobile subscriber to address the reasons for the GPRS Attach rejection without requiring the subscriber identification module to be either re-programmed or replaced.

[0023] As described above, the IMSI contains information that can indicate the home network of a mobile device. This information is typically used by a network to determine if a subscriber is roaming or not. If the subscriber is determined to be a roaming subscriber, the information in the IMSI is used by the roaming networks VLR to determine the mobile device's home network so that the VLR can connect to the HLR of the home network of the mobile device. In the method of the present invention, upon receiving the GPRS Attach rejection, the mobile device will inspect the rejection to determine if the cause for the rejection is "GPRS Services Not Allowed". If that cause is not provided, the GPRS Attach rejection is handled as defined by the 3GPP specifications, or other known methods. However, if the reason for the GPRS Attach rejection is "GPRS Services Not Allowed", the mobile device will determine which network has rejected its GPRS Attach request. This determination is typically made using a Public Land Mobility Network (PLMN) identification number. Upon connecting to a wireless network, the PLMN identification number is made available to the mobile device. If the mobile device receives a GPRS Attach rejection, it can compare the PLMN identification number with the portion of the IMSI that indicates the home network of the mobile device. If this determination indicates that the home network is rejecting the GPRS Attach request then the mobile device can block all GPRS Attach requests as done in the prior art. Alternatively, if the GPRS Attach rejection is made by a roaming network, the mobile device can add the

PLMN number of that network to a PLMN block list. This list will prevent the user from repeatedly requesting a GPRS Attach from the same network, but will allow the user to make GPRS Attach requests to other networks. This will provide the mobile subscriber with the ability to address the reason for the GPRS Attach failure with their home network operator, and then connect to another GPRS network. Additionally, network operator security concerns are addressed by preventing non-authorised mobile device from making repeated attach requests. In this presently preferred embodiment of the present invention, the failure to connect to a home network will result in the blocking of all GPRS networks, as it indicates that the mobile subscriber has not subscribed to GPRS services. Any subscription request to GPRS services can also be accompanied by the re-programming of the SIM to allow the user to connect to other networks.

[0024] Figure **2** illustrates a method of the present invention for handling a rejection from a GPRS Attach where the message in the rejection is "GPRS Services Not Allowed". In the first step of the method, the "GPRS Services Not Allowed" message is received at step **120**. In step **122** the rejecting network ID number is compared to the ID number of the mobile device's home network, which is derived from the mobile device's IMSI. If the rejecting network is determined to be the home network, the SIM is deregistered in **124**. If the rejecting network is determined to not be the home network, the rejection network ID number is identified in step **126**. In step **128**, the rejecting network ID number is added to the GPRS block list.

[0025] The use of the block list is illustrated in Figure **3**, which shows a method of the present invention for use by a mobile device connecting to a network and requesting GPRS services. As in the prior art, the first step is to connect to the VLR in **130**. Upon connecting to the VLR, the network ID number is determined in step **132**. The block list is examined in step **134** for the determined network ID. If the determined network ID is on the block list, the mobile device disconnects from the roaming network in **136**. If the network is not on the block list, the mobile device will receive an authentication request in step **138**. In response to the received authentication request, the mobile device will transmit the authentication reply in step **140**. As in the prior art, there are a number of authentication requests that will be understood by one of skill in the art, any of these authentication requests can be used with the present invention. After transmitting the authentication reply in step **140**, a GPRS Attach reply is received in step **142**. In step **144**,

the reply is examined to determine if it is a rejection. If the reply is not a rejection, in step **146** the mobile device will acknowledge the connection and start the data session with the roaming network. If in step **144**, it is determined that the reply is GPRS Attach rejection, the rejection is examined in step **148**. Step **148** determines if the reason for the rejection is "GPRS Services Not Allowed". If this message is not included in the GPRS Attach rejection, the rejection is handled according to prior art methods in step **150**. If this message is present in the GPRS Attach rejection, the mobile device uses the method illustrated in Figure **2** starting at step **120**.

[0026] When connecting to the home network, it is possible to use a similar method as that employed in Figure **3**, with the substitution of the HLR for the VLR. However, in the preferred embodiment, a receiving "GPRS Services Not Allowed" from the home network results in the deregistration of the SIM, so further GPRS connections cannot be made. This obviates the need for inspecting the ID of the home network to determine if it is on the block list, as the connection request is not typically be transmitted by the mobile device.

[0027] Fig. **4** is a schematic diagram of a wireless communication device that could be used with the systems and methods described herein. Turning now to Fig. **4**, a block diagram of an illustrative dual-mode example mobile device is shown. The mobile device **400** is preferably a two-way communication device having at least voice and data communication capabilities. The mobile device preferably has the capability to communicate with other computer systems on the Internet. Depending on the functionality provided by the device, the device may be referred to as a data messaging device, a two-way pager, a cellular telephone with data messaging capabilities, a wireless Internet appliance or a data communication device

[0028] Where the mobile device **400** is enabled for two-way communications, it will incorporate a communication subsystem **411**, including both a receiver **412** and a transmitter **414**, as well as associated components such as one or more, preferably embedded or internal, antenna elements **416** and **418**, local oscillators (LOs) **413**, and a processing module such as a digital signal processor (DSP) **420**. As will be apparent to those skilled in the field of communications, the particular design of the communication subsystem **411** will be dependent upon the communication network in which the device is intended to operate. For example, a mobile device **400** may include a communication

subsystem **411** designed to operate within the Mobitex™ mobile communication system, the DataTAC™ mobile communication system, or a GPRS network.

[0029] Network access requirements will also vary depending upon the type of network **419**. For example, in the Mobitex and DataTAC networks, mobile devices **400** are registered on the network using a unique identification number associated with each mobile device. In GPRS networks however, network access is associated with a subscriber or user of a mobile device **400**. A GPRS mobile device therefore requires a subscriber identity module, commonly referred to as a SIM card, in order to operate on a GPRS network. Without a valid SIM card, a GPRS mobile device will not be fully functional. Local or non-network communication functions, as well as legally required functions (if any) such as "911" emergency calling, may be operable, but the mobile device **400** will be unable to carry out any other functions involving communications over the network **419**. The SIM interface **444** is normally similar to a card-slot into which a SIM card **445** can be inserted and ejected like a diskette or a PCMCIA card. The SIM card **445** can have approximately 64K of memory and holds identification, subscriber related information and configurations **450**.

[0030] When required network registration or activation procedures have been completed, a mobile device **400** may send and receive communication signals over the network **419**. Signals received by the antenna **416** through a communication network **419** are input to the receiver **412**, which may perform such common receiver functions as signal amplification, frequency down conversion, filtering, channel selection and the like, and in the example system shown in Fig. **4**, analog to digital conversion. Analog to digital conversion of a received signal allows more complex communication functions such as demodulation and decoding to be performed in the DSP **420**. In a similar manner, signals to be transmitted are processed, including modulation and encoding for example, by the DSP **420** and input to the transmitter **414** for digital to analog conversion, frequency up conversion, filtering, amplification and transmission over the communication network **419** via the antenna **418**.

[0031] The DSP **420** not only processes communication signals, but also provides for receiver and transmitter control. For example, the gains applied to communication signals in the receiver **412** and transmitter **414** may be adaptively controlled through automatic gain control algorithms implemented in the DSP **420**.

[0032] The mobile device **400** preferably includes a microprocessor **438**, which controls the overall operation of the device. Communication functions, including at least data and voice communications, are performed through the communication subsystem **411**. The microprocessor **438** also interacts with further device subsystems such as the display **422**, flash memory **424**, random access memory (RAM) **426**, auxiliary input/output (I/O) subsystems **428**, serial port **430**, keyboard **432**, speaker **434**, microphone **436**, a short-range communications subsystem **440** and any other device subsystems generally designated as **442**.

[0033] Some of the subsystems shown in Fig. 4 perform communication-related functions, whereas other subsystems may provide "resident" or on-device functions. Notably, some subsystems, such as keyboard **432** and display **422** for example, may be used for both communication-related functions, such as entering a text message for transmission over a communication network, and device-resident functions such as a calculator or task list.

[0034] Operating system software used by the microprocessor **438** is preferably stored in a persistent store such as flash memory **424**, which may instead be a read only memory (ROM) or similar storage element (not shown). Those skilled in the art will appreciate that the operating system, specific device applications, or parts thereof, may be temporarily loaded into a volatile store such as RAM **426**. Received communication signals may also be stored to RAM **426**. The Block List **452** is preferably stored in the RAM **426**.

[0035] As shown, the flash memory **424** can be segregated into different areas for computer programs **451**. These different PIM storage types indicate that each program can allocate a portion of flash memory **424** for their own database requirements. The microprocessor **438**, in addition to its operating system functions, preferably enables execution of software applications on the mobile device. A predetermined set of applications that control basic operations, including at least data and voice communication applications for example, will normally be installed on the mobile device **400** during manufacturing. A preferred software application may be a personal information manager (PIM) application having the ability to organize and manage data items relating to the user of the mobile device such as, but not limited to, e-mail, calendar events, voice mails, appointments, and task items. Naturally, one or more memory stores would be available

on the mobile device to facilitate storage of PIM data items. Such PIM application would preferably have the ability to send and receive data items, via the wireless network **419**. In a preferred embodiment, the PIM data items are seamlessly integrated, synchronized and updated, via the wireless network **419**, with the mobile device user's corresponding data items stored or associated with a host computer system. Further applications may also be loaded onto the mobile device **400** through the network **419**, an auxiliary I/O subsystem **428**, serial port **430**, short-range communications subsystem **440** or any other suitable subsystem **442**, and installed by a user in the RAM **426** or preferably a non-volatile store (not shown) for execution by the microprocessor **438**. Such flexibility in application installation increases the functionality of the device and may provide enhanced on-device functions, communication-related functions, or both. For example, secure communication applications may enable electronic commerce functions and other such financial transactions to be performed using the mobile device **400**.

[0036] In a data communication mode, a received signal such as a text message or web page download will be processed by the communication subsystem **411** and input to the microprocessor **438**, which preferably further processes the received signal for output to the display **422**, or alternatively to an auxiliary I/O device **428**. A user of mobile device **411** may also compose data items such as email messages for example, using the keyboard **432**, which is preferably a complete alphanumeric keyboard or telephone-type keypad, in conjunction with the display **422** and possibly an auxiliary I/O device **428**. Such composed items may then be transmitted over a communication network through the communication subsystem **411**.

[0037] For voice communications, overall operation of the mobile device **400** is similar, except that received signals would preferably be output to a speaker **434** and signals for transmission are be generated by a microphone **436**. Alternative voice or audio I/O subsystems such as a voice message recording subsystem may also be implemented on the mobile device **400**. Although voice or audio signal output is preferably accomplished primarily through the speaker **434**, the display **422** may also be used to provide an indication of the identity of a calling party, the duration of a voice call, or other voice call related information for example.

[0038] The serial port **430** would normally be implemented in a personal digital assistant (PDA)-type mobile device for which synchronization with a user's desktop

computer (not shown) may be desirable, but is an optional device component. Such a port **430** would enable a user to set preferences through an external device or software application and would extend the capabilities of the mobile device **400** by providing for information or software downloads to the mobile device **400** other than through a wireless communication network. The alternate download path may for example be used to load an encryption key onto the device through a direct and thus reliable and trusted connection to thereby enable secure device communication.

[0039] A short-range communications subsystem **440** is a further optional component, which may provide for communication between the mobile device **400** and different systems or devices, which need not necessarily be similar devices. For example, the subsystem **440** may include an infrared device and associated circuits and components or a Bluetooth™ communication module to provide for communication with similarly-enabled systems and devices.

[0040] The encoding and decoding techniques employed by the presently preferred embodiment are defined as part of the GSM specification. Microprocessor **438** has access to identifying information, including authentication and ciphering information, through the connection with SIM **445**. Additionally, microprocessor **438** can access block list **452**, which stores the list of network ID's that have rejected a GPRS Attach request with "GPRS Services Not Allowed". Upon connecting to a network, the network ID is compared to the entries in the block list **452**. If a match is found, microprocessor **438** will terminate the connection. If no match is found, microprocessor **438** will follow the above described method of connecting and handling rejections. Upon receiving a "GPRS Services Not Allowed" rejection, the rejecting network ID is added to block list **452** by microprocessor **438**. Block list **452** is stored in memory available to microprocessor **438**, and in one embodiment may reside in RAM **426**.

[0041] The above-described embodiments of the present invention are intended to be examples only. Alterations, modifications and variations may be effected to the particular embodiments by those of skill in the art without departing from the scope of the invention, which is defined solely by the claims appended hereto.

What is claimed is:

1. A method for handling a Generalised Packet Radio Service (GPRS) Attach rejection, from networks having network identifiers, at a digital wireless mobile device associated with a home network, the method comprising:

receiving a GPRS Attach rejection from a network; and

adding the network identifier of the rejecting network to a block list which prohibits the mobile device from re-establishing a connection with a listed network.

2. The method of claim 1, wherein the step of adding the network identifier to a block list is performed only if the rejecting network is determine to not be the home network.

3. The method of claim 1, wherein the determination that the rejecting network is not the home network is made by comparing an International Mobile Subscriber Identity (IMSI) associated with the mobile device to the network identifier of the rejecting network.

4. The method of claim 3, further including the step of de-registering the mobile device if the rejecting network is the home network.

5. The method of claim 1, wherein receiving the rejection includes receiving a GPRS Services Not Allowed rejection.

6. A method of initiating a data connection to networks having network identifiers, from a mobile device having a network block list containing a list of blocked network identifiers, the method comprising:

receiving a network identification number from a network; and

receiving and replying to an authentication request if the network identification number does not reside in the network block list, otherwise disconnecting from the network.

7. The method of claim 6, wherein receiving the authentication request includes receiving a request for a cipher code.

8. The method of claim 7, wherein replying to the authentication request includes retrieving the requested cipher code from a Subscriber Identification Module (SIM) and transmitting the retrieved cipher code to the network.

9. The method of claim 6, wherein receiving the authentication request includes receiving an Identity Request.

10. The method of claim 9, wherein replying to the authentication request includes retrieving an IMSI from a SIM and transmitting the retrieved IMSI to the network.

11. The method of claim 6, further including the step of receiving a Temporary Mobile Subscriber Identity (TMSI) from the network in response to the reply.

12. The method of claim 11, wherein the TMSI is a packet temporary mobile subscriber identity.

13. The method of claim 11, wherein the TMSI is received from a Serving GPRS Support Node in the network.

14. A mobile device, associated with a home network, for data communication with networks, associated with network identifiers, through a transmitter and a receiver, the mobile device having a subscriber identification module for storing identifying information comprising:

a block list for storing network identifiers associated with networks that have rejected connections; and

a processor for disconnecting from a network if the network identifier associated with the network is in the block list, and for adding a network identifier to the block list if the network associated with the network identifier rejects a connection.

15. The mobile device of claim **14**, wherein the processor includes means for adding a network identifier to the block list if the network associated with the network identifier rejects a connection, and is not the home network.

16. The mobile device of claim **15**, wherein the processor includes means for determining if the rejecting network is the home network by comparing the network identifier to an IMSI stored in the SIM.

17. The mobile device of claim **14**, wherein the processor includes means for deregistering the SIM if the rejecting network is the home network.

18. The mobile device of claim **14**, wherein the processor includes means to transmit the identifying information stored in the SIM to the network, through the transmitter, in response to an authentication request.

19. The mobile device of claim **14**, wherein the mobile device further comprises a random access memory (RAM) wherein the block list resides in the RAM

20. The mobile device of claim **14**, wherein the processor includes means for adding a network identifier to the block list if the network associated with the network identifier rejects a connection due to GPRS Services Not Available.

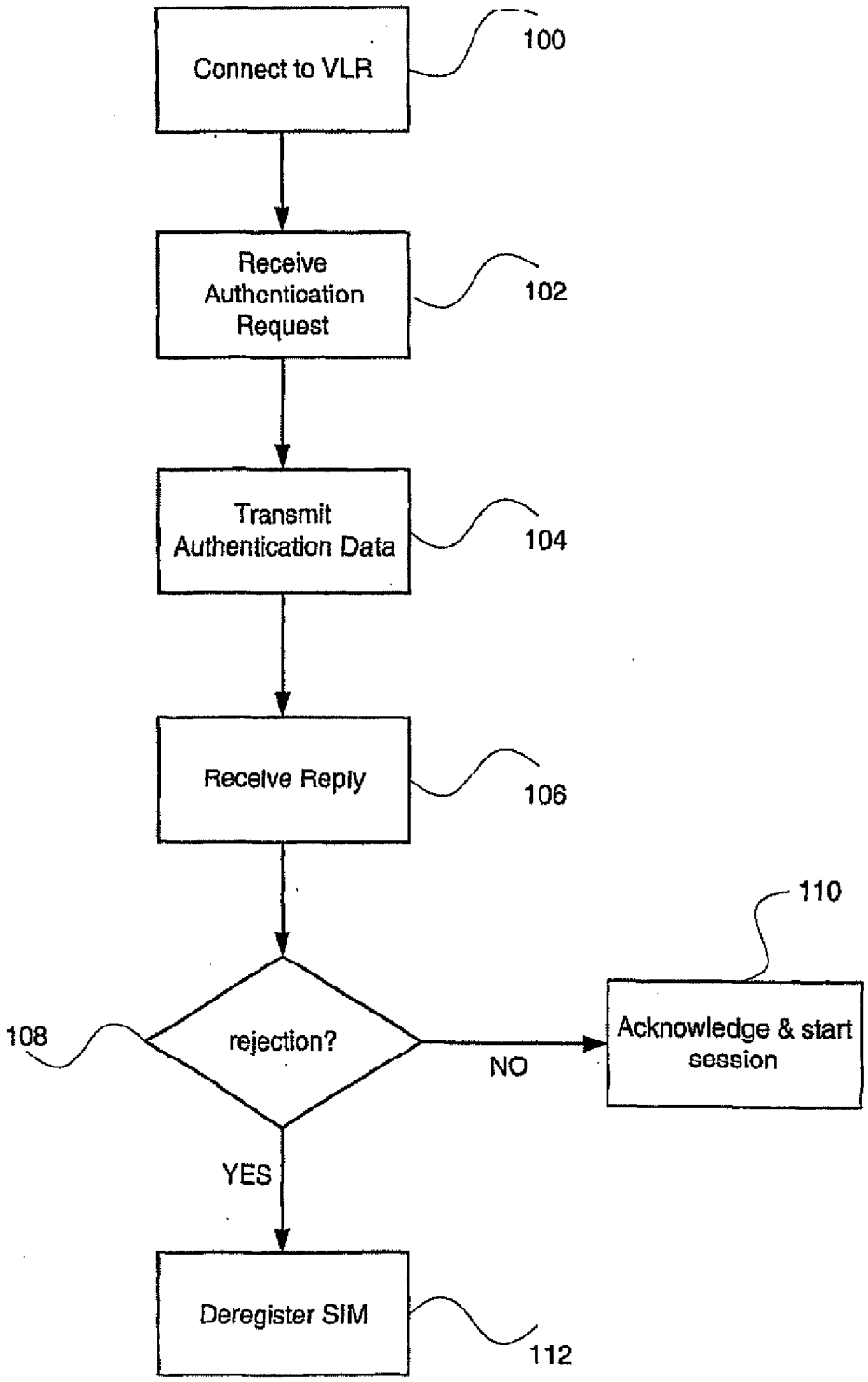
Connect to VLR
100
Receive Authentication Request
102
Transmit Authentication Data
104
Receive Reply
106
110
108
rejection?
NO
Acknowledge & start session
YES
Deregister SIM
112

Figure 1

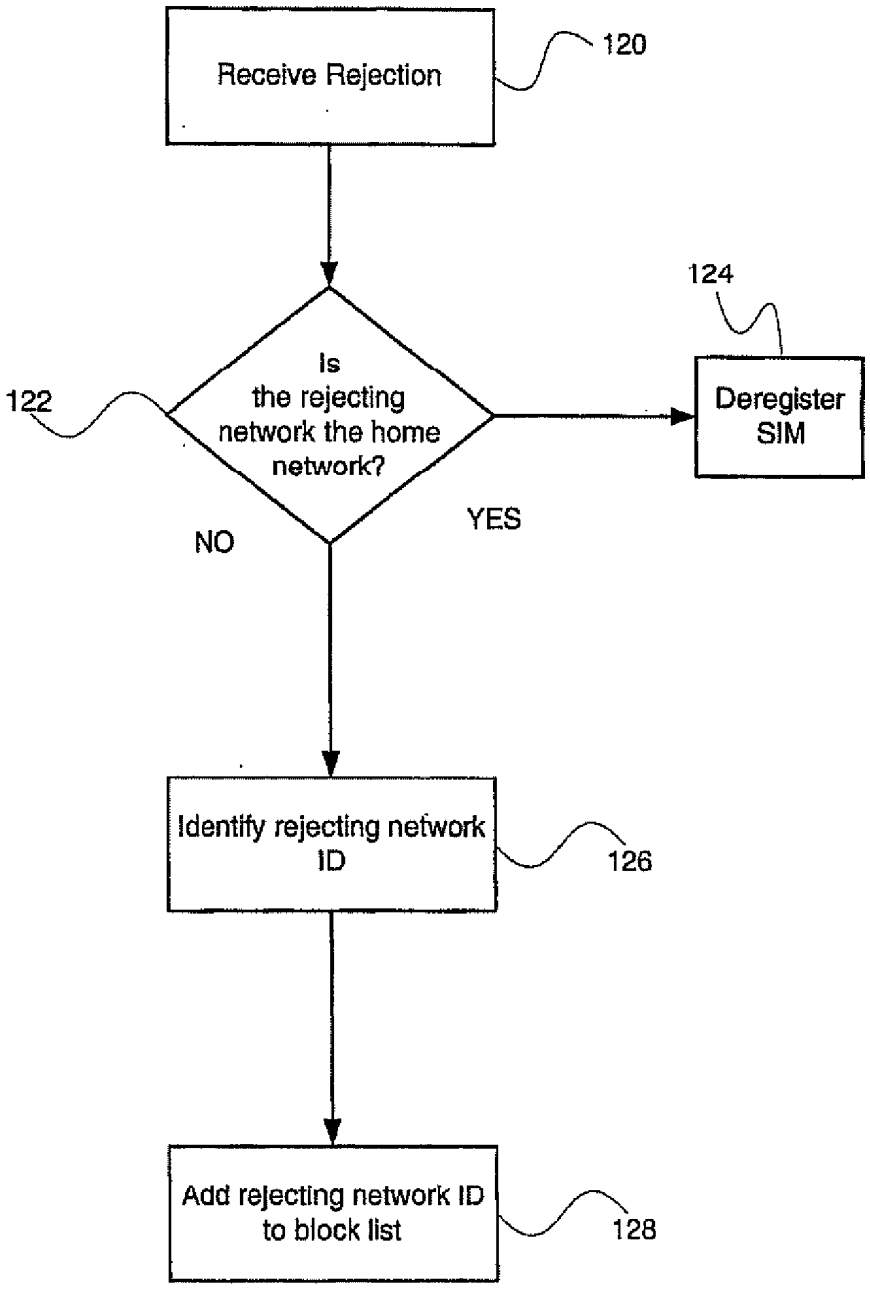
Receive Rejection
120
Is the rejecting network the home network?
122
124
Deregister SIM
YES
NO
Identify rejecting network ID
126
Add rejecting network ID to block list
128

Figure 2

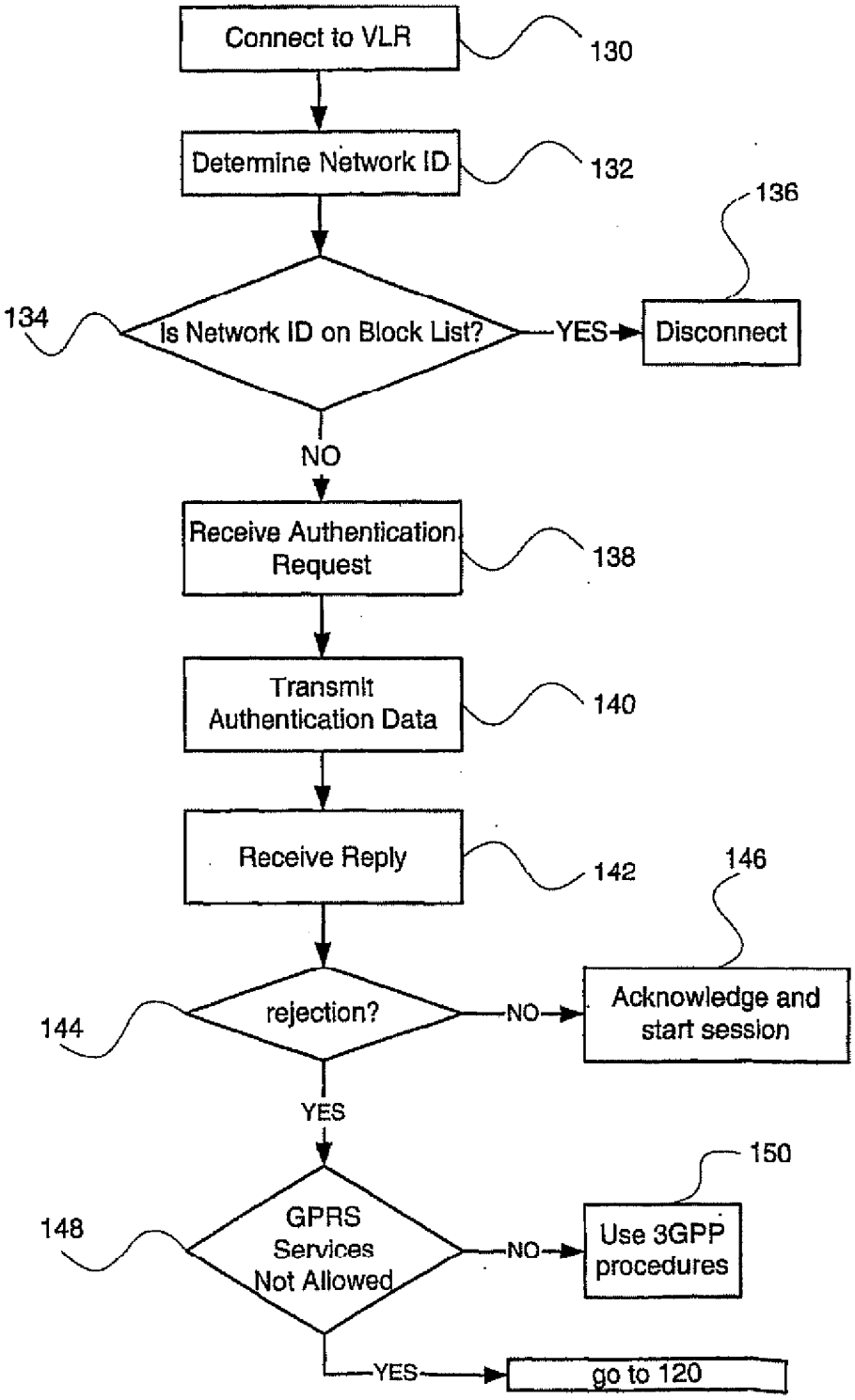
Connect to VLR
130
Determine Network ID
132
136
134
Is Network ID on Block List?
YES
Disconnect
NO
Receive Authentication Request
138
Transmit Authentication Data
140
Receive Reply
142
146
144
rejection?
NO
Acknowledge and start session
YES
150
148
GPRS Services Not Allowed
NO
Use 3GPP procedures
YES
go to 120

Figure 3

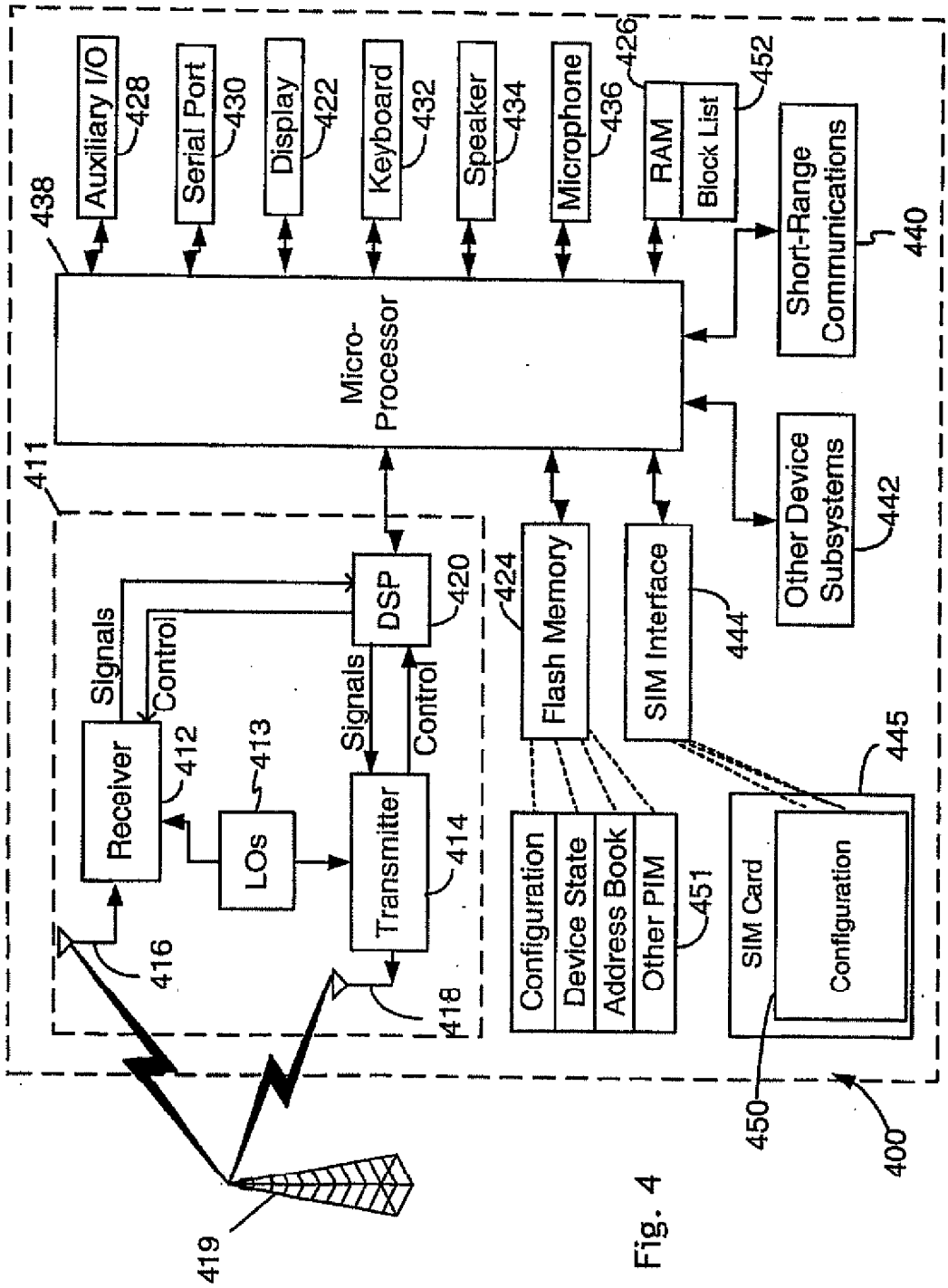
Auxiliary I/O
428
Serial Port
430
Display
422
Keyboard
432
Speaker
434
Microphone
436
RAM
426
Block List
452
438
Micro-Processor
Short-Range Communications
440
411
Other Device Subsystems
442
DSP
420
Flash Memory
424
SIM Interface
444
Signals
Control
Receiver
412
LOs
413
Signals
Control
Transmitter
414
Configuration
Device State
Address Book
Other PIM
451
SIM Card
Configuration
445
416
418
419
450
400

Fig. 4

INTERNATIONAL SEARCH REPORT

Iational Application No
PCT/CA 02/01454

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L12/56 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	"ETSI TS 123 122 V4.1.0: Universal Mobile Telecommunication System (UMTS);Non-Access-Stratum functions related to Mobile Station (MS) in idle mode (3GPP TS 23.122 version 4.1.0 Release 4" ETSI TS 123 122 V4.1.0, XX, XX, June 2001 (2001-06), pages 1-34, XP002209390 page 10, line 13 - line 19 -/--	1-20

[X] Further documents are listed in the continuation of box C.

[ ] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 November 2002	09/12/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Chêne, X

INTERNATIONAL SEARCH REPORT

International Application No
PCT/CA 02/01454

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	"Change Request 23.122 CR 16 rev 1 Current version 3.5.0: Roaming restrictions for GPRS service" 3GPP TSG-CN1 MEETING #15 TDOC N1-010224, 15 - 19 January 2001, pages 1-14, XP002222097 Beijing, China the whole document	1-20